

## P20

### Cine MRI assessment of carotid artery pulse wave velocity and reflected wave amplitude in children with sickle cell disease

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**Introduction:** In sickle cell disease (SCD), cerebral microvasculature function is impaired resulting in an increased risk of ischemic injury [1]. This function may be assessed by quantifying the time-varying blood flow and lumen area of the common carotid artery (CCA) across a cardiac cycle to derive pulse-wave velocity (PWV) and wave reflection coefficient ( $\Gamma$ ) [2]. PWV describes the speed of pressure waves and is related to the characteristics of the vessel walls. The wave reflection caused by downstream changes in vessel morphology is described by  $\Gamma$ . In this study, we used cine MRI to measure PWV and  $\Gamma$  in the CCA of children with SCD and healthy controls. We hypothesize that the PWV and  $\Gamma$  in SCD will be higher due to poorer vessel compliance and microvascular abnormalities.

**Materials & methods:** Six patients with SCD ( $14.5 \pm 2.3$  years) and 3 healthy controls underwent imaging on a 3T clinical MRI system. To quantify intravascular flow and vessel size, a high resolution phase contrast MRI (PCMRI; voxel =  $0.29 \times 0.29$  mm, phases = 20) scan was acquired, consisting of a single slice radial acquisition perpendicular to the CCA. The acquisition strategy was adapted from real-time cardiac imaging with an ECG-free retrospective gating approach [3]. Raw data was reconstructed offline and analyzed using Segment (v2.0 R5557; <http://segment.heiberg.se>). PWV was calculated as the slope between area vs. flow during the systolic phase, and  $\Gamma$  as the ratio of backward to forward wave amplitude at the first harmonic (see Figure) [2]. Group averages of PWV and  $\Gamma$  were compared using Student's t-test, with statistical significance defined as  $p < 0.05$ .

**Results:** Mean PWV was significantly greater in the SCD group compared to controls ( $348 \pm 47$  cm/s vs.  $272 \pm 73$  cm/s;  $p = 0.017$ ). Furthermore, mean  $\Gamma$  was also shown to be higher in SCD patients ( $0.52 \pm 0.14$  cm/s vs.  $0.37 \pm 0.06$  cm/s;  $p = 0.027$ ).

**Conclusion:** Using PCMRI, we were able to characterize the flow and reflection properties in the CCA and show significant differences between pediatric SCD patients and healthy controls. These measures may aid in the clinical evaluation of children with SCD.

#### References:

1. Kosinski PD, et al. Br J Haematol. 2016;176(2).
2. Macgowan CK, et al. J Cereb Blood Flow & Metab. 2015;35.
3. Roy CW, et al. J Cardiovasc Magn Reson. 2017;19(1).

Figure legend: (A) Computation of PWV from the slope of the flow vs. area curve. (B) Flow curves separated into forward and backward waves.

Figure 1:

